DIVISION 6 – STORMWATER MANAGEMENT

DIVISION 6

STORMWATER MANAGEMENT

601 STORM DRAIN PIPE AND FITTINGS

601.01 DESCRIPTION

601.01.A This work consists of furnishing and installing gravity storm drain pipe and fittings, culverts, and perforated underdrains typically associated with storm drain systems.

601.01.B The Contractor shall provide all materials, labor, equipment, tools, etc., and perform all required work and services necessary for and incidental to completing the Work as shown on the Plans and in complete accordance with the Specifications.

601.01.C Supplementary or miscellaneous items, equipment, appurtenances, or devices necessary for or incidental to a complete and functional installation, whether or not shown on the Plans or addressed in the Specifications, shall be provided and installed as part of the Work.

601.01.D CERTIFICATION OF MATERIALS

1. The Contractor shall furnish manufacturers certification for construction materials when such information is requested by the City Engineer. Certification submitted to the City Engineer shall be sufficient to show the materials meet the specified requirements. All information and cut sheets shall be originals, copies will not be accepted. A minimum of 5 original certification documents shall be provided. Costs associated with providing certification, including materials and testing, shall be borne by the Contractor.

601.02 MATERIALS

601.02.A GENERAL

1. Use storm drain pipe and fittings of the size, strength, material, and joint type specified on the drawings and/or in the Contract Documents. Use jointing material as hereinafter specified for each pipe material. Each piece of pipe shall be clearly identified as to strength, class, and date of manufacture. The manufacturer or fabricator shall furnish appropriate certification, based on manufacturer's routine quality control tests, that the materials in the pipe and fittings meet the requirements specified herein. Strength, permeability, hydrostatic tests, and pipe joints will be used as the basis of acceptance as described under Subsection 601.03.R. Minimum length of pipe shall be 3 1/2-feet.

2. It is not intended that materials listed herein are to be considered equal or to be generally interchangeable for all applications. The type, class, and size of pipe as applicable, will be specified in the Contract Documents for all City improvement projects. The City Engineer shall determine the materials suitable for the project and so specify.

3. Use pipe and fittings for service branches of one type of material throughout; no interchanging of pipe and fittings will be allowed.

4. Do not coat pipes for storm drains, internally or externally, with any substance of any type in an attempt to improve its performance when air or hydrostatically tested.

5. The Contractor shall furnish Materials and shall perform Work in Close Conformance to the Plans and Specifications. See Section 106.07 for acceptability of Materials and Work.

601.02.B NON-REINFORECED CONCRETE PIPE

1. Non-reinforced concrete pipe shall conform to ASTM C-14 Class III or as shown or specified and the following additional requirements:

   a. Cement shall be Type II conforming to ASTM C-150

   b. The minimum Portland Cement content shall be five-hundred and sixty-four (564) pounds per cubic yard

   c. The water/cement ratio shall not exceed 0.49.

   d. The Contractor shall provide the City Engineer with a Certificate of Compliance from the pipe manufacturer that the pipe and concrete mix conform in all respects to these specifications and other non-conflicting requirements of the referenced ASTM Specifications.

   e. Use rubber gaskets for bell and spigot pipe conforming to ASTM C-443.

601.02.C REINFORCED CONCRETE PIPE (RCP)

1. Reinforced concrete pipe shall conform to ASTM C-76 Class III or as shown or specified with Wall B design and the following additional requirements:

   a. Cement shall be Type II or Type III conforming to ASTM C-150.

   b. The minimum Portland Cement content shall be 564 pounds per cubic yard.

   c. The water/cement ratio shall not exceed 0.49.

   d. The pipe shall have circular reinforcement. Elliptical reinforcement is not permitted.

   e. The Contractor shall provide the City Engineer with a Certificate of Compliance from the pipe manufacturer that the pipe and concrete mix conforms in all respects to these specifications and other non-conflicting requirements of the referenced ASTM specifications.

2. JOINTS FOR REINFORCED CONCRETE PIPE (RCP)

a. Use rubber gaskets for bell and spigot pipe conforming to ASTM C-443 except as modified herein.

b. Use captive gasket in groove design for pipe 24-inches diameter and larger. Mortar for tongue and groove pipe shall conform to Section 208.

c. Use only lubricants for jointing materials approved by the manufacturer.

d. Furnish in duplicate a certified statement from the manufacturer of the gaskets, setting forth the basic polymer used in the gaskets and results of the tests of the physical properties of the compound. Gaskets shall be shipped in containers with identification of the batch from which the gaskets were fabricated

e. The following specification is for concrete storm drain pipes with a nominal inside diameter equal to or greater than 24-inches:

1) GENERAL

a) The joint assemblies shall be so formed and manufactured that when the pipe is drawn together in the trenches, the pipe shall form a continuous watertight conduit with a smooth and uniform interior surface, and shall provide for slight movements of any pipe in the pipeline due to expansion, contraction, settlement, or lateral displacement. The rubber gasket shall be the sole element of the joint depended upon to provide water tightness. The ends of the pipe shall be in planes at right angles to the longitudinal centerline of the pipe, except where bevel-end pipe for deflections up to 5 degrees is specified or indicated for bends. Joint faces shall be finished to regular, smooth surface and shall have all surface points within 1/4-inches of a theoretical plane taken normal to the pipe axis.

2) DESIGN

a) The shape and dimensions of the joint shall be such as to provide the following minimum requirements:

1) The rubber gaskets shall be solid gaskets of circular cross section.

2) The gasket shall be confined in a groove in the spigot end of the pipe so that movement of the pipe or hydrostatic pressure cannot displace the gasket. When the joint is assembled, the gasket shall be compressed to form a watertight seal.

3) The volume of the annular space provided for the gasket, with the engaged joint a normal joint closure in concentric position, shall not be less than the design volume of the gasket. The cross-sectional area of the annular space calculated for minimum bell diameter, maximum spigot diameter, minimum width of groove at surface of spigot, and minimum depth of groove. The volume of the annular space shall be calculated considering the centroid of the cross-sectional area to be at the midpoint between the inside bell surface and the surface of the groove on which the gasket is seated at the centerline of the groove.

4) Each gasket shall be manufactured to provide the design volume of rubber required by the joint design used and within a tolerance of ±3 percent for gaskets up to and including 1/2-inch diameter and ±1 percent for gaskets of 1-inch diameter and larger. The allowable percent tolerance shall vary linearly between ± 3 percent and ±1 percent for gasket diameters between 1/2-inch and 1-inch.

5) The tolerances permitted in the construction of the joint shall be those stated for joint design.

6) The taper on all surfaces on the bells and/or spigots on which the rubber gaskets may bear during closure of the joint and at any degree of partial closure, except within the gasket groove, shall not exceed 2 degrees.

3) The City Engineer will utilize the joint data to review acceptable joint gap for the particular joint design submitted. The gap will be established by subtracting the settlement allowance, from the Table below, from the total distance over which the joint may be pulled while meeting the provisions of this specification, or shall be equal to 1 1/2-inches, whichever is smaller.

SETTLEMENT ALLOWANCE	
Pipe Inside Diameter (Inches)	**Settlement Allowance (Inches)**
30 or less	3/8
36	1/2
42	1/2
48	5/8
54	5/8
60	3/4
66	3/4
72	7/8
84 or more	1

4) The surfaces of the bell and spigot in contact with the gasket and adjacent surfaces that may come in contact with the gasket within the specified joint movement range, shall be free from defects.

a) The inside surface of the bell adjacent to the bell face shall be flared to facilitate joining the pipe sections without damaging or displacing the gasket.

b) In pipes 36-inches or more in diameter, the bell and the spigot of the joint shall contain both circumferential and longitudinal reinforcement. For double-cage pipe, the reinforcement shall be at least equal in area to that of the outside cage or line for bells and the inside cage of line for spigots. For single-cage pipe, the reinforcement shall be at least equal in area to that of the cage for the bell and the spigot. The location of reinforcement shall be subject, however, to the permissible variations in dimensions given in the "position of reinforcement" sections in the appropriate ASTM Standard Specification (C-76, C-655, etc.)

5) APPROVAL OF JOINTS

a) A detail showing exact dimensions of the joint and diameter of rubber gaskets, including tolerances, and details of the spigot groove, and other required data shall be submitted to the City Engineer for approval.

1) Any fabrication or procurement of material performed prior to approval of details shall be at the Contractor's risk. Approval of the pipe details by the City shall not relieve the Contractor of any of his responsibility to meet all the requirements of these specifications or of the responsibility for the correctness of the pipe details.

2) No visible leakage will be permitted.

3) Contractor shall be responsible for checking pipe dimensions and any problems that may arise.

6) MATERIAL FOR RUBBER GASKETS

a) Material for rubber gaskets shall conform to ASTM C-443.

601.02.D PERFORATED CONCRETE PIPE

1. Perforated concrete pipe and fittings shall conform to ASTM C-444 and applicable requirements of ASTM C14 and C76 as modified herein, class and end type as specified.

601.02.E DUCTILE IRON PIPE

1. Ductile iron pipe shall conform to requirements of Subsection 501.02.B.

601.02.F POLYVINYL CHLORIDE (PVC) PIPE

1. PVC pipe shall conform to requirements of Subsection 501.02.C and Subsection 501.02.D.

601.02.G PERFORATED PVC PIPE

1. Perforated PVC pipe shall conform to ASTM D-1785, Schedule 40. The perforations shall consist of two rows of 2-inch slots. The slots shall be transverse to the axis of the pipe. Two rows of slots shall be 120 degree on centers. Slot size shall be 0.4-inches.

601.02.H HIGH DENSITY POLYETHYLENE PIPE (HDPE)

1. Smooth interior, corrugated exterior HDPE pipe and associated HDPE fittings shall be watertight and shall conform to AASHTO M-252 and AASHTO M-294. All smooth interior corrugated exterior pipes shall be bell and spigot type pipe.

2. Solid wall HDPE pipe shall conform to the requirements of Subsection 501.02.E.

601.02.I FLARED END SECTIONS

1. Precast concrete flared-end sections shall conform to the requirements for Reinforced Concrete Pipe herein specified. The area of steel reinforcement per linear foot of flared-end section shall be at least equal to the minimum steel requirements for circular reinforcement in circular pipe for the internal diameter of the circular portion of the flared-end section. Submit all details of construction to the City Engineer.

601.02.J JOINTING MATERIALS (GASKETS)

1. GENERAL

   a. Only lubricants for jointing materials approved by the manufacturer shall be used.

   b. Furnish to the City Engineer a certified statement from the manufacturer of the gaskets, setting forth the basic polymer used in the gaskets, and results of the tests of the physical properties of the compound. Gaskets shall be shipped in containers with identification of the batch from which the gaskets were fabricated.

2. CONCRETE PIPE

   a. Rubber gaskets for bell and spigot pipe shall conform to ASTM C-443.

3. DUCTILE IRON PIPE

   a. Rubber gaskets shall conform to ANSI A21.11/AWWA C111.

4. POLYVINYL CHLORIDE (PVC) PIPE

   a. Rubber gaskets for PVC pipe shall conform to ASTM F-477.

5. HDPE PIPE

   a. Rubber gaskets for HDPE pipe shall conform to ASTM D-3212.

601.02.K FITTINGS

1. At locations where approved by City Engineer, provide tee fittings in the storm drain main for inlet connections. Manufactured tees for service branch storm drains shall be a minimum of 6-inches nominal diameter, unless otherwise specified. All fittings shall be of sufficient strength to withstand all handling and load stresses encountered, including pressure testing that will be encountered in the work. All fittings shall be of the same materials as the pipe unless otherwise specified. Material joining the fittings to the pipe shall be free from cracks and shall adhere tightly to each joining surface. Use the same type of joints on all fittings that are used on the main storm drain pipe. Tee fittings shall not be closer than 18-inches to any joint or bell of main line storm drain.

2. Fittings shall conform to the requirements of Subsection 501.02.G, except for those shown below.

3. CONCRETE FITTINGS

   a. Use only shop fabricated fittings on concrete pipes.

   b. Submit fabrication details to the City Engineer for shop-fabricated fittings for review prior to delivery of fittings to the job site.

   c. Concrete fittings shall have the same strength classification as the concrete pipe on which the fittings are being used.

601.02.L PIPE COUPLING ADAPTERS

1. Pipe coupling adapters shall conform to the requirements of Subsection 501.02.H.

601.02.M CLEANOUTS

1. Pipe for cleanouts shall be of the same material as the main line. Cleanouts shall be of the same size as the line it is serving or shall be 8-inch nominal diameter, whichever is smaller.

601.02.N LOCATING WIRE

1. Locating wire shall be a minimum of 12 AWG, UF solid copper wire with green colored insulation. The use of THHN wire will not be acceptable. Splices shall only be used when necessary. At splices, the connecting ends of the wires shall be stripped, overlapped, and tied. Splice shall made waterproof with an approved waterproof silicone splice kit. Contractor shall ensure splices have a waterproof electrical connection at all times.

601.02.O SERVICE CONNECTION MARKERS

1. Service connection markers shall be 2-inch x 4-inch pressure treated random length lumber. Markers shall be continuous and extended at least 2-feet above the ground surface.

601.03 CONSTRUCTION

601.03.A EXCAVATION AND BACKFILL

1. Conform to the requirements of Subsection 501.03.A.

601.03.B LINE AND GRADE FOR GRAVITY STORM DRAINS

1. Do not deviate from the line or grade, as established by the City Engineer, more than 1/2-inch for line and 1/4-inch for grade, provided that such variation does not result in a level or reverse sloping invert. Measure for grade at the pipe invert, not at the top of the pipe, because of permissible variation in pipe wall thickness.

2. Line and grade for pipe shall be established and maintained by the use of pipe lasers. The Contractor shall check the line and cut from the offset stakes at maximum intervals of 50-feet.

3. Any pipe or run of pipe that has not been installed within the allowable tolerance for line and grade shall be removed and reinstalled or replaced as necessary to bring the work into compliance with the specified requirements

601.03.C PIPE DISTRIBUTION AND HANDLING

1. Pipe distribution and handling shall conform to Subsection 501.03.C.

601.03.D PIPE LAYING AND JOINTING OF PIPE AND FITTINGS

1. Pipe laying and jointing of pipe and fittings shall conform to Subsection 501.03.D, except for those shown below.

2. Provide all concrete pipes, 36-inches or smaller in diameter, entering or leaving manholes or other structures, with flexible joints within 18-inches of the exterior wall. Concrete pipes larger than 36-inches in diameter shall have this flexible joint within a distance from the exterior wall equal to one-half the nominal pipe diameter.

3. CONCRETE PIPE

   a. Use rubber ring gasket joints.

   b. Bell ends of pipe with bell and spigot joints shall be cleaned of rock and other debris prior to assembly of the joint. Spigot ends of pipe with a confined-gasket design shall be cleaned and the gasket lubricated prior to assembly of the joint

4. LAYING AND JOINTING PERFORATED PIPE

   a. Securely fasten together perforated pipe with couplings, fittings, or bands as specified by the manufacturer for the type of the pipe used. Close upgrade ends of all subsurface drain pipe with approved plugs to prevent entry of soil materials.

b. Begin pipe laying normally at the outlet end of the pipe line. The lower segment of pipe shall be in contact with the shaped bedding throughout its full length. Bell or groove ends of rigid pipe and outside circumferential laps of flexible pipe shall be placed facing the upgrade end.

c. Lay all perforated pipe, except perforated PVC pipe, with perforations facing down, unless otherwise specified or directed. Place perforated PVC pipe with slots facing up.

d. Inspect all pipes prior to lowering into the trench and clean off any material tending to plug the perforations of the pipe. Carefully lower all pipe and fittings into the trench to avoid any contamination of the pipe bedding material.

601.03.E PIPE COUPLING ADAPTERS

1. Prior to installing mechanical couplers and adapters, pipe ends shall be sawcut as necessary to produce an edge that is free of cracks or other irregularities. Pipe ends shall be cut perpendicular to the length of the pipe.

2. After installation of the coupler or adaptor, pipe zone materials shall be thoroughly compacted to maintain proper alignment of the flow line and to prevent any movement of the pipe ends.

601.03.F INSTALLATION OF SERVICE LINES, TEES, AND WYES

1. Service lines shall be constructed in accordance with the Plans, Standard Drawings, Standard Construction Specifications, and applicable provisions of the Oregon Plumbing Specialty Code.

2. Existing service shall not be interrupted without the approval of the City Engineer and service owner and/or user. The Contractor shall obtain all necessary permits required to construct service lines on both public and private property.

3. Connection of service lines to new or existing gravity main lines shall be as per the Plans and shall be inspected and accepted by the City Engineer prior to backfilling. All service connections shall be watertight utilizing appropriate tees, wyes, and approved taps or service saddles. An approved tee or wye manufactured fitting shall be used when new mains are being constructed. All holes and taps into an existing main shall be cut using an approved tapping machine in the presence of the City Engineer.

4. The minimum slope of service lines shall be 1/4-inch per foot unless otherwise approved by the City Engineer. The pipe size of service lines shall be a minimum 4-inch diameter unless otherwise specified. Maximum vertical deflection permissible with any one fitting shall not exceed 45 degrees, unless otherwise approved. No horizontal deflection is allowed. Ends of service lines shall be at the location and elevation shown on the Plans.

5. Install continuous 12 gauge green locating wire from mainline wire up to the ground surface at the property line cleanout, then loop back down to the end of the service, and then up along the service connection marker, as shown in the Standard Drawings.

6. Provide pipe-bedding material, compacted to a minimum of 90 percent of maximum density as determined by AASHTO T-180, under tees, wyes, and service branch fittings extending to the springline of the fittings. Place pipe bedding material on undisturbed native material or compacted foundation stabilization material.

7. Provide ends of service lines and fittings with approved watertight plugs or caps suitably secured and braced to prevent blow-off during internal air testing. Such plugs or caps shall be removable and their removal shall provide a socket suitable for making a flexible joint service connection or extension.

601.03.G LOCATING WIRE

1. A continuous looped solid copper tracer or locating wire shall be taped along the top of all mainlines and service lines. These wires shall be secured to the top of the pipe at maximum 10-foot intervals using 6-inch strips of 2-inch wide duct tape. All splices shall be tied, electrically continuous, and made waterproof. Access to terminal ends of the locating wire shall be made at all manholes, service line cleanouts, and as shown on the Plans. The result of this installation shall be a continuous wire circuit electrically isolated from the ground.

2. The Contractor shall be responsible for testing continuity and for testing isolation from the ground in the wire after all work has been completed on the test section. The Contractor is advised to do intermediate testing after backfilling operations and prior to surface restoration work to be sure continuity is maintained. If there is a break or defect in the wire, it shall be the Contractor's responsibility to locate and repair the defect. The continuity of the location wire shall be tested from one test load point to the next by use of a temporary wire laid between test points in-line with an ohmmeter.

601.03.H SERVICE CONNECTION MARKERS

1. In new subdivisions, undeveloped areas, and where connections will not be made after the service is installed, block the capped or plugged end and install a continuous 2-inch x 4-inch pressure treated marker. Extend markers at least 2-feet above the ground surface.

2. The top portion of the marker shall be painted after its installation with first-quality white, quick-drying enamel. After the paint has dried, use black, quick-drying enamel and neatly indicate the distance from the natural ground surface to the top of the service pipe in feet and inches. If curbs are present or to be poured as part of the project, stamp the top of the curb and gutter pan with an "SD" over the service crossing.

3. Markers shall be in one continuous piece. Splicing of lumber used for markers is only permitted in situations where the depth of the pipe is in excess of standard lumber lengths. Markers shall be installed in a vertical position with the bottom end of the marker against the end of the pipe. Markers that are broken, too short, or are not installed vertically in the ground shall be replaced by removing the backfill and replacing and/or repositioning the marker. In areas where it is not practical to extend markers above the ground surface, as approved by the City Engineer, the tops of the markers shall be installed flush with the ground surface.

601.03.I CLOSURE COLLARS

1. The use of concrete closure collars in lieu of mechanical-type couplers or other specified or approved connection materials and procedures is not permitted unless approved by the City Engineer. Where approved by the City Engineer, closure collars shall conform to Subsection 501.03.I.

601.03.J FLARED END SECTIONS

1. Construct flared end sections for culverts in accordance with the details and dimensions shown, except that minor variations may be accepted to permit the use of the manufacturer's standard prefabricated sections and methods of fabrication. Conform the excavation, bedding and backfill to applicable requirements herein for the adjacent pipe or drain to be joined.

601.03.K REPAIR OF EXISTING UTILITIES

1. Existing utilities that are damaged as a result of the Contractor's operations shall be repaired immediately at the Contractor's expense.

601.03.L UTILITY CROSSINGS

1. Minimum allowable clearance between pipes at crossings shall be 6-inches, unless otherwise approved by City Engineer.

601.03.M CONCRETE PIPE ENCASEMENT

1. Where required or approved by the City Engineer, the installation of concrete encasement shall conform to applicable requirements in Section 209.03.O.2.

601.03.N FIELD FABRICATED CONNECTIONS

1. The use of field fabricated connections is not permitted unless approved by the City Engineer. "Insert-a-tees" or approved equal shall be used in lieu of field fabricated connections. See Standard Drawings.

601.03.O CLEANOUTS

1. Cleanouts will be constructed per the Standard Drawings. The cleanout will stand vertical and the Contractor will bring compacted bedding material up around the vertical portion of the top. Frames and covers shall comply with requirements of Subsection 502.02.G.

601.03.P CULVERTS

1. Remove and replace culverts in conformance to all applicable requirements of this section and Section 209.

601.03.Q SURFACE RESTORATION

1. Surface restoration shall be in conformance with applicable requirements of Section 212, Section 213, and Section 215.

601.03.R TESTING STORM DRAINS

1. GENERAL

    a. Storm drain systems shall be thoroughly jetted and cleaned by the Contractor, at the Contractor's expense, prior to paving operations. After jet cleaning, the Contractor shall deflection test all flexible pipes in accordance with Subsection 501.03.Q.6.

b. After the Contractor has jetted and cleaned the pipe, the City will, at no additional expense to the Contractor, make a televised inspection of the storm drain pipe after the Contractor has completed the installation of the pipe, including backfill, deflection tests, and other tests as required by the Contract Documents. The City inspection shall be scheduled by the Contractor with the City. Any defects in material or workmanship shall be satisfactorily corrected by the Contractor at no expense to the City. The Contractor shall re-CCTV, at the Contractor's expense, the pipe after any corrections, in accordance with Subsection 501.03.Q.9 and supply the CCTV video and the report to the City Engineer for review and approval. This process will repeat until the pipe complies with the specifications. City acceptance is required prior to any paving operations.

2. CLEANING PRIOR TO TESTING AND ACCEPTANCE

a. Cleaning shall conform to the applicable portion of Subsection 501.03.Q.3.

3. REPAIRS

a. Repair or replace, in accordance with Subsection 601.03.D and in a manner satisfactory to the City Engineer, any section of pipe not meeting the air test requirements, deflection test requirements, joint testing requirements, alignment requirements, or that has leakage. Re-rounding of flexible pipe will only be allowed if approved by the City Engineer.

601.04 MEASUREMENT AND PAYMENT

(Not applicable to privately financed public improvements)

601.04.A STORM DRAIN PIPE

1. Measurement and payment for installation of storm drain pipe, including culverts, will be made on a lineal foot basis for the various classes, types, and sizes of pipe listed in the Contract Documents and as actually installed.

2. Pipe will be measured horizontally from center-to-center of manholes or to the ends of the pipe, whichever is applicable. No deductions will be made for fittings or for structures, unless specifically called out in the Contract Documents or elsewhere in these Standards Specifications.

3. Payment for pipe installation shall constitute full compensation for labor; equipment; materials; clearing and grubbing; trench excavation; provision and installation of pipe bedding, pipe zone material, and backfill; compaction operations; flushing and cleaning; testing; fittings, spools, and mechanical couplings required to complete the pipeline as designed; connection to and abandonment of existing pipe systems; installation of markers; toning wire and marking tape; surface restoration, unless included in the Contract Documents as a separate pay item; and any other incidental expenses necessary to construct the pipeline in conformance with the Contract Documents.

601.04.B PERFORATED PIPE UNDERDRAINS

1. Measurement and payment for perforated drain pipe will be made on a lineal foot basis for the type and size of pipe installed as shown in the Contract Documents. Length will be measured as total length of pipe installed, including fittings measured along the pipe centerline. Payment shall constitute full compensation for trench excavation, special filter material for pipe bedding and trench backfill, and all other work specified to complete the installation of the perforated drain pipe complete in place.

601.04.C FLARED END SECTIONS

1. Measurement and payment for flared end sections will be made on a unit price basis for each type and size actually installed as shown in the Contract Documents. Payment shall include full compensation for the flared end section complete in place including concrete cutoff walls and toe plates, when required.

601.04.D INCIDENTALS

1. Other materials, labor, and equipment required to complete the storm drain pipe and fittings work in conformance with the contract documents and not listed as separate pay items in the proposal will be considered incidental to other items of work and no separate payment will be made.

602 MANHOLES, INLETS, AND CONCRETE STRUCTURES

602.01 DESCRIPTION

602.01.A This work consists of furnishing and installing manholes, inlets and catch basins, sumps, special concrete structures, concrete encasements, anchor walls, and other concrete structures typically associated with storm drain systems.

602.01.B The Contractor shall provide all materials, labor, equipment, tools, etc., and perform all required work and services necessary for and incidental to completing the Work as shown on the Plans and in complete accordance with the Specifications.

602.01.C Supplementary or miscellaneous items, equipment, appurtenances, or devices necessary for or incidental to a complete and functional installation, whether or not shown on the Plans or addressed in the Specifications, shall be provided and installed as part of the Work.

602.01.D CERTIFICATION OF MATERIALS

1. The Contractor shall furnish manufacturers certification for construction materials when such information is requested by the City Engineer. Certification submitted to the City Engineer shall be sufficient to show the materials meet the specified requirements. All information and cut sheets shall be originals, copies will not be accepted. A minimum of 5 original certification documents shall be provided. Costs associated with providing certification, including materials and testing, shall be borne by the Contractor.

602.02 MATERIALS

602.02.A GENERAL

1. It is not intended that materials listed herein are to be considered equal or to be generally interchangeable for all applications. The type, class, and size as applicable, will be specified in the Contract Documents. The City Engineer shall determine the materials suitable for the project and so specify.

602.02.B BASE ROCK

1. Use 3/4"-0" or 1"-0" granular base rock as approved, conforming to the requirements for aggregate base material in Subsection 208.02.D.

602.02.C FORMS

1. Forms for exposed surfaces shall be steel or plywood. Other surfaces shall be formed by means of matched boards, plywood, or other approved material. Form all vertical surfaces. Trench walls, large rock, and earth shall not be used as form material.

602.02.D CONCRETE AND REINFORCED STEEL

1. Concrete and reinforcing steel shall conform to Section 208.

602.02.E PORTLAND CEMENT CONCRETE AND MORTAR

1. When specified for use, cement mortar shall conform to Section 208. Consistency of mortar shall be such that it will readily adhere to the pipe. Mortar mixed for longer than 30 minutes shall not be used.

602.02.F MANHOLES

1. Conform to requirements of Subsection 502.02.F.

602.02.G MANHOLE FRAMES AND COVERS

1. Manhole frames and cover requirements shall be in accordance with Subsection 502.02.G.

602.02.H STEPS FOR PRECAST MANHOLES

1. Manhole frames and cover requirements shall be in accordance with Subsection 502.02.H.

602.02.I NON-SHRINK GROUT

1. Conform to requirements of Subsection 208.02.G.3.

602.02.J PIPE AND FITTINGS

1. Conform to requirements of Section 601.

602.02.K SEDIMENTATION MANHOLE AND STORM SUMP SYSTEMS (where approved)

1. Where approved, the precast sections shall comply with Subsection 502.02.F. The frame and cover shall comply with Subsection 502.02.G and shall be tamper-proof when the system is located outside the right-of-way. The steps shall comply with Subsection 502.02.H.

602.02.L STORM DRAIN INLETS AND CATCH BASINS

1. GENERAL

   a. All catch basins shall be precast or cast-in-place, as shown in the Standard Drawings.

2. PRECAST INLETS AND CATCH BASINS

   a. Precast, reinforced concrete storm drain inlet and catch basin bases, extension rings, and tops (for curb inlets) shall conform to ASTM C-913. The top section, including curb, gutter, and frame, shall be cast-in-place in accordance with applicable portions of Section 208, unless otherwise approved by City Engineer. Precast concrete risers for base extensions shall be a minimum of 4-inches in height and shall have the same wall thickness as the base section.

3. FRAME AND GRATE ASSEMBLIES FOR INLETS AND CATCH BASINS

   a. Frame and grate assemblies for inlets and catch basins shall be fabricated of steel conforming to ASTM A-36 and A-373 in accordance with the specifications shown on the Standard Drawings.

   b. All connections shall be welded. Welding shall conform to applicable requirements of the American Welding Society.

   c. The grate shall fit in the frame without binding and shall bear evenly on the seat without rocking.

602.03 CONSTRUCTION

602.03.A GENERAL

1. EXCAVATION AND BACKFILL

   a. Conform to applicable provisions in Section 207 and Section 209. Backfill around manholes, inlets, catch basins, and other appurtenances shall be of the same type as the trench backfill immediately adjacent.

2. BASE ROCK

   a. Place crushed granular base rock and thoroughly compact with compaction equipment of suitable type to obtain the specified compaction and density requirements.

3. FOUNDATION STABILIZATION

   a. If material in bottom of excavation is unsuitable for supporting manholes and other storm drain appurtenances, excavate below subgrade as directed and backfill to required grade with rock conforming to Foundation Stabilization in Subsection 209.03.H.

602.03.B MANHOLES

1. Manhole requirements shall conform to Subsection 502.03.B.

602.03.C PIPE STUB-OUTS FROM MANHOLES

1. Pipe stub-outs from manholes shall be installed in accordance with Subsection 502.03.C.

602.03.D MANHOLE GRADE RINGS

1. Manhole grade rings shall be installed in accordance with Subsection 502.03.D.

602.03.E MANHOLE FRAMES AND COVERS

1. Manhole frames and covers shall be installed in accordance with Subsection 502.03.E.

602.03.F MANHOLE STEPS

1. Steps shall comply with requirements of Subsection 502.03.F.

602.03.G LEAKAGE TESTING OF MANHOLES

1. When required by the Contract Documents, manholes shall be required to pass tests as specified in Subsection 502.03.G.

602.03.H PIPE ANCHOR BLOCKS

1. See Standard Drawings. Do not over-excavate in the areas where the anchor blocks are to be poured. Construct suitable forms that will allow the downhill wall face to have a full-bearing surface against undisturbed earth.

602.03.I SPECIAL CONCRETE STRUCTURES

1. Conform to the details shown in Contract Documents.

602.03.J CONSTRUCTION OF INLETS AND CATCH BASINS

1. GENERAL

   a. Install inlets and catch basins at the locations shown in the Contract Documents. Construct inlets and catch basins as shown on the Standard Drawings.

b. Base rock shall be graded and thoroughly compacted before placing the base. For precast bases, the base section shall be set such that the tops of the base section, riser sections, and extensions are level and plumb.

c. The curb and gutter top section over catch basins shall be cast-in-place. Frames shall be cast in the concrete when forming the top section. Frame anchors shall be firmly embedded in the concrete. Frame-bearing surfaces shall be clean and provide for uniform contact with the grate.

d. Any surrounding structures (e.g., pavement, curbs, gutters, sidewalks, driveways) and landscaping damaged during installation of inlets or catch basins shall be restored in accordance with the Construction Standard Specifications at no expense to the City.

2. PIPE CONNECTIONS TO INLETS AND CATCH BASINS

a. Openings for pipe connections to precast structures shall be core-drilled. Openings for stubouts shall be the minimum size necessary to accept the pipe. Pipe connections shall be made to the sides of base section.

b. Pipes shall be installed flush with the inner wall of the structure. Pipe to structure connections shall be sealed with non-shrinking grout.

3. INLET AND CATCH BASIN EXTENSIONS

a. The number of precast extensions necessary to adjust the structure to the specified grade shall be kept to a practicable minimum. The use of several shorter extensions where a fewer number of taller extensions could be used is not permitted.

b. Extensions shall be set in mortar with sides plumb and tops to grade. The interior and exterior of the mortared joints shall be troweled smooth.

c. Extensions shall be watertight.

602.03.K SEDIMENTATION MANHOLE AND STORM SUMP SYSTEMS (where approved)

1. Precast sedimentation manhole and storm sump systems shall be used, unless approved otherwise. Maximum depth of storm sumps shall not exceed 30-feet as measured from the manhole rim and shall not be less than 20-feet unless approved by the City Engineer.

2. Precast perforated sump sections encased with HDPE netting shall have the HDPE netting overlap a minimum of 1-foot. Netting shall be banded in 3 locations per manhole section with 3/4-inch steel bands. The first band shall be located above the weephole openings; the second shall be located at mid-section; and the third shall be located below the weep hole openings.

602.03.L CLEANING

1. Upon completion of the work, structures shall be cleaned of silt, rock, and other debris.

2. Where possible, such materials shall be removed through the top of the structure. When flushing is required to completely remove the materials, appropriate precautions shall be taken to trap the debris at the nearest downstream structure.

3. Final cleaning shall comply with requirements of Section 215.

602.04 MEASUREMENT AND PAYMENT

(Not applicable to privately financed public improvements)

602.04.A MANHOLES

1. Measurement and payment for manholes will be made on a unit price basis for each type shown in the Contract Documents for concrete manholes 0 to 8-feet deep, plus the unit price per foot shown in the Contract Documents for extra depth of manholes over 8-feet. No deduction will be made for depths less than 8-feet. Measurement of manhole depth will be from the top of the manhole frame and cover to the manhole invert at the center of the manhole to the nearest 1/10-foot.

2. Measurement and payment for manhole steps shall be made as part of the installation or modification of manholes. No separate payment shall be made for manhole steps.

3. Payment shall include full compensation for materials, labor, and equipment necessary for excavation and disposal of excess materials; preparation of aggregate base; construction of the manhole including installation of the channel, pipe connections, and installation of the frame and cover assembly to finish grade; and acceptance testing.

602.04.B PIPE STUBOUTS FROM MANHOLES

1. Measurement and payment for pipe stubouts from manholes shall be made at the unit price per Subsection 601.04.A for pipe of equal size. Unit price will include all required materials, fittings (including end plug), and work to install the stubout.

602.04.C TAMPERPROOF AND WATERTIGHT MANHOLE FRAMES AND COVERS

1. Measurement and payment for tamperproof manhole frame and covers shall be considered incidental to the construction of manholes and no separate payment shall be made.

602.04.D PIPE ANCHOR BLOCKS

1. Measurement and payment for anchor blocks shall be made on a unit price basis for each unit installed. Payment shall include full compensation for all materials, equipment, and labor necessary to construct the work complete-in-place.

602.04.E SPECIAL CONCRETE STRUCTURES

1. Measurement and payment for special concrete structures will be made on a lump sum each basis. Payment shall constitute full compensation for materials, equipment and labor required to construct the work complete in place.

602.04.F INLETS AND CATCH BASINS

1. Measurement and payment for catch basins and inlets will be made on a unit-price basis.

2. Payment shall include full compensation for materials, equipment, and labor necessary for excavation and disposal of excess materials; preparation of aggregate base; and construction of the catch basin or inlet including installation of the pipe connections and the frame and grate assembly to finish grade.

602.04.G SEDIMENTATION MANHOLE AND STORM SUMP SYSTEMS

1. Measurement and payment for precast sedimentation manhole and storm sump systems will be made on a unit price basis per each system constructed. Payment shall include full compensation for all materials, equipment, and labor required to construct the work complete in-place, including the replacement of any surrounding structures damaged during construction.

602.04.H INCIDENTALS

1. Other materials, labor, and equipment required to complete the manholes, inlets, and concrete structures work in conformance with the contract documents and not listed as separate pay items in the proposal will be considered incidental to other items of work and no separate payment will be made.

603 WORK ON EXISTING STORM DRAINS

603.01 DESCRIPTION

603.01.A This section covers the work necessary to join new work to existing, the abandoning of storm drains and structures, and adjusting existing utility structures to finished grades, and shall included the requirements of Sections 601 and 602 unless otherwise modified herein.

603.01.B MANUFACTURER'S CERTIFICATION

1. The Contractor shall furnish manufacturers certification for construction materials when such information is requested by the City Engineer. Certification submitted to the City Engineer shall be sufficient to show the materials meet the specified requirements. Information and cut sheets shall be originals, copies will not be accepted. A minimum of 5 original certification documents shall be provided. Costs associated with providing certification, including materials and testing, shall be borne by the Contractor.

603.02 MATERIALS

603.02.A GENERAL

1. Conform to requirements of Section 601, 602, and 208, the Contract Documents, and additional requirements contained herein. .

603.03 CONSTRUCTION

603.03.A EXCAVATION AND BACKFILL

1. Conform to requirements of Section 209.

2. Backfill around manholes, inlets, catch basins, and other appurtenances shall be the same type as the adjacent trench backfill.

603.03.B MANHOLES OVER EXISTING STORM DRAINS

1. Manholes over existing storm drains shall conform to the applicable requirements of Subsection 503.03.B.

603.03.C CONNECTION TO EXISTING STRUCTURES

1. Connections to existing structures shall conform to the applicable requirements of Subsection 503.03.C.

603.03.D REMOVAL OF EXISTING STRUCTURES

1. Removal of existing pipes, manholes, inlets and catch basins, and appurtenances shall conform to the requirements of Subsection 503.03.D.

603.03.E ABANDONED OF MANHOLES, INLETS, CATCH BASINS, AND STORM SUMPS

1. Abandoment of manholes, inlets, and catch basins and similar structures shall conform to the requirements of Subsection 503.03.E.

603.03.F EXISTING MANHOLE FRAMES AND COVERS

1. Requirements for existing manhole frames and covers shall be according to Subsection 503.03.F.

603.03.G PERMANENT PLUGS

1. Requirements for permanent plugs shall be according to Subsection 503.03.G.

603.03.H ADJUSTING EXISTING STRUCTURES TO GRADE

1. Existing manholes, inlets, catch basins, and similar structures shall be brought to the specified finished grade by methods of construction as required in Section 310.

603.03.I RECONSTRUCT MANHOLE BASE

1. Reconstruct manhole bases in accordance with requirements of Subsection 503.03.I.

603.03.J CONNECTIONS TO EXISTING STORM DRAIN PIPES

1. GENERAL

   a. The methods and materials used in tapping existing storm drain pipes shall conform to requirements specified in the Contract Documents and to applicable requirements specified herein.

   b. Tap connections shall not protrude beyond the interior wall surface of the existing pipe.

2. STORM DRAIN TAPS (WHERE APPROVED)

   a. Connections to storm drain pipes shall be made with approved fittings and materials that are compatible with the size and type of pipe being tapped.

   b. Connections to aluminum or steel pipe shall be made by sawcutting a hole in the pipe and installing a prefabricated tapping saddle over the opening in accordance with the manufacturer's recommendations.

   c. Stainless steel nuts and bolts shall be used for the installation of these saddles. Bolts shall be installed through the pipe from the inside to avoid unnecessary protrusions on the interior wall of the pipe.

   d. Concrete storm drain pipe shall be sawcut and the pipe wall removed only to the extent necessary to tap the pipe. After the tap is set to specified grade and alignment, grout shall be used the fill the annular space between the pipe and the tap.

   e. Mechanical taps, saddles, or tees shall be used to tap PVC storm drain pipe.

603.03.K CONNECT PIPE TO EXISTING INLETS AND CATCH BASINS

1. Conform to applicable requirements of Section 502. Sawcut opening in inlet with a concrete saw and grout in a watertight seal between the new pipe and inlet wall. Plaster mortar smooth inside pipe opening. Alignment, slope of pipe, and other construction details shall be as specified.

603.03.L STORM SUMP PROTECTION

1. When a storm sump is encountered, the Contractor will take all precautions to protect the structure and replace all disturbed structures and materials to their original condition. Notify the City Engineer immediately.

603.03.M SEDIMENTATION MANHOLE AND STORM SUMP SYSTEM RETROFITS

1. Where approved, conform to applicable requirements of Sections 502, 209, and 208. Precast sedimentation manhole and storm sump systems shall be constructed in conformance with the applicable requirements for Sedimentation Manhole and Storm Sump Systems of Sections 602 and 603 herein.

603.04 MEASUREMENT AND PAYMENT

(Not applicable to privately financed public improvements)

603.04.A MANHOLES OVER EXISTING STORM DRAINS

1. Measurement and payment for manholes constructed over existing storm drain pipe will be made in conformance with Subsection 503.04.A.

2. Payment shall also include full compensation for materials, labor, and equipment necessary for maintaining flow through the existing pipe and for removal, replacement, or reconstruction of the existing pipe during construction of the manhole.

603.04.B REMOVAL OF EXISTING PIPES, MANHOLES, AND APPURTENANCES

1. Payment for removal and disposal of existing pipes, manholes, and appurtenances will be considered as incidental to the work and included in the bid item for excavation and backfill as specified in Section 209.04.

603.04.C CONNECTION TO EXISTING MANHOLES, INLETS, AND CATCH BASINS.

1. Measurement and payment for connection to existing manholes, inlets, and catch basins will be made on a unit price each basis if shown in the Contract Documents. If no bid item is included in the Contract Documents for "connection to existing manholes", all costs will be considered incidental work for which no separate payment will be made.

2. Payment shall include full compensation for materials, labor, and equipment necessary for excavation and disposal of excess materials; core drilling and/or sawcutting of the existing structure as specified; preparation of aggregate base; construction of a grout seal or installation of flexible mechanical connectors where required; and installation of the stubout.

3. Taps, tees, and similar connections to storm drain pipes will be considered incidental to other appropriate bid items and no separate payment will be made.

603.04.D ABANDONMENT OF MANHOLES, INLETS, CATCH BASINS, AND STORM SUMPS

1. Measurement and payment for abandonment of manholes, inlets, catch basins and storm sumps and other similar structures will be made on a unit price each basis if shown in the Contract Documents. If no item is included in the Contract Documents for "abandonment of existing manholes", all costs will be considered incidental work for which no separate payment will be made.

603.04.E ADJUSTING EXISTING STRUCTURES TO GRADE

1. Measurement and payment for adjusting existing manholes, catch basins, inlets, and similar structures will be made on a unit-price-each basis for the type shown in the Contract Documents. If no item is included in the Contract Documents for "adjust existing structures to grade", all costs will be considered incidental work for which no separate payment will be made.

603.04.F RECONSTRUCT MANHOLE BASE

1. Measurement and payment for reconstructing manhole base will be made on a unit-price-each basis if shown in the Contract Documents. If no item is included in the Contract Documents for "reconstruct manhole base", all costs will be considered incidental work for which no separate payment will be made.

603.04.G CONNECT TO EXISTING INLET OR CATCH BASIN

1. Measurement and payment for connecting new pipe to existing catch basins will be made on a unit-price-each basis if shown in the Contract Documents. If no item is included in the Contract Documents for "connect to existing catch basin", all costs will be considered incidental work for which no separate payment will be made.

603.04.H STORM SUMP PROTECTION

1. Measurement and payment for storm sump protection will be made on a unit-price-each basis if shown in the Contract Documents. Compensation will be for all materials, labor, and equipment necessary to bring the structure equal to its original undisturbed condition.

2. If no item is included in the Contract Documents for "storm sump protection", all costs will be considered incidental work for which no separate payment will be made.

603.04.I SEDIMENTATION MANHOLE AND STORM SUMP SYSTEM RETROFITS

1. Measurement and payment for retrofit of sedimentation manhole and storm sump systems will be made on a unit price basis per each line item in the Contract Documents. Payment shall include full compensation for all materials, equipment, and labor required to construct the work complete and in-place, including the replacement of any surrounding structures damaged during construction.

603.04.J INCIDENTALS

1. Other materials, labor, and equipment required to complete the work on existing storm drains in conformance with the Contract Documents and not listed as separate pay items in the proposal will be considered incidental to other items of work and no separate payment will be made.

END OF DIVISION